

CLAIMS:

1. A drive circuit for an electrophoretic matrix display with a plurality of pixels (18), the drive circuit comprising:
 - a select driver (16) for selecting lines of the pixels (18),
 - a data driver (10) for supplying drive waveforms (VD) to the selected pixels
 - 5 (18) via data electrodes (5, 5'), and
 - a controller (15) for controlling the select driver (16) to select a group of lines of pixels (18) at the same time during a portion of the drive waveforms (VD) being identical for at least all selected pixels (18) of each one of the data electrodes (5, 5').
- 10 2. A drive circuit as claimed in claim 1, wherein the controller (15) is arranged for controlling the select driver (16) to select the group of lines of pixels (18) during a group select period during which the drive voltage waveform (VD) has a predetermined level.
3. A drive circuit as claimed in claim 2, wherein the controller (15) is arranged
- 15 for controlling the select driver (16) to select the group of lines during the group select period which has a duration longer than a line period (TL) but smaller than a frame period (TF), a duration of the frame period (TF) being defined as the time required to select all lines of pixels (18) of the electrophoretic matrix display one by one, the line period (TL) being the frame period (TF) divided by a number of lines of the electrophoretic matrix display.
- 20 4. A drive circuit as claimed in claim 1, wherein the controller (15) is arranged for controlling the select driver (16) to select said group of lines during a line period (TL) being a frame period (TF) divided by a number of lines of the electrophoretic matrix display, to decrease a duration of an image update period (IUP), a duration of the frame period (TF)
- 25 being defined as the time required to select all lines of pixels (18) of the electrophoretic matrix display one by one.
5. A drive circuit as claimed in claim 2, wherein the controller (15) is arranged for controlling the select driver (16) to select a predetermined number of groups of lines of

pixels (18) each comprising a predetermined number of lines of pixels (18), the predetermined number of groups of lines of pixels (18) and the predetermined number of lines of pixels (18) of each of the groups of lines of pixels (18) being selected to cover all lines of pixels (18) of the electrophoretic matrix display, each one of the groups of lines of pixels (18) being selected during the group select period which has a duration selected in the interval: a single line period (TL) to a single frame period (TF) divided by the predetermined number of the groups of lines of pixels (18), the line period (TL) being the frame period (TF) divided by a number of lines of the electrophoretic matrix display, a duration of the frame period (TF) being defined as the time required to select all lines of pixels (18) of the electrophoretic matrix display one by one.

6. A drive circuit as claimed in claim 2, wherein the controller (15) is arranged for controlling the select driver (16) to select the group of lines comprising all lines of pixels (18) of the electrophoretic matrix display during the group select period which has a duration selected in the interval: a single line period (TL) to a single frame period (TF), the line period (TL) being the frame period (TF) divided by a number of lines of the electrophoretic matrix display, a duration of the frame period (TF) being defined as the time required to select all lines of pixels (18) of the electrophoretic matrix display one by one.

7. A drive circuit as claimed in claim 1, wherein the controller (15) is arranged for controlling during a first display mode wherein all pixels (18) are updated, the select driver (16) to select successively n groups of lines of pixels (18), the lines of pixels (18) of each one of said n groups of lines being selected at the same time during the portion of the drive voltage waveforms (VD) being identical for at least all the selected pixels (18) of each one of the data electrodes (5, 5'), and during a second display mode wherein only the pixels (18) in a sub-area (W1) of the display are updated, the select driver (16) to select the group of lines of pixels (18) at the same time within the sub-area (W1) only, the group of lines of pixels (18) being selected during a portion of the drive voltage waveforms (VD) being identical for at least all the selected pixels (18) of each one of the data electrodes (5, 5').

8. A drive circuit as claimed in claim 1, wherein the controller (15) is arranged for controlling

during a first display mode wherein all pixels (18) are updated, the select driver (16) to select successively *n* groups of lines of pixels (18), the lines of pixels (18) of each one of said *n* groups of lines being selected at the same time during a portion of the drive voltage waveforms (VD) being identical for at least all the selected pixels (18) of each

5 one of the data electrodes (5, 5'),

during a second display mode wherein only the pixels (18) in a sub-area of the display are updated, the select driver (16) to select the lines of pixels (18) within the sub-area (W1) only, the lines of pixels (18) within the sub-area (W1) being selected one by one.

10 9. An electrophoretic display comprising a drive circuit as claimed in claim 1.

10. An electrophoretic display as claimed in claim 9, wherein the pixels (18) comprise an electrophoretic material (8, 9) comprising charged particles, each one of the pixels (18) being associated with a first electrode (6) and one of the data electrodes (5, 5'),

15 the data driver (10) being arranged for presenting the drive voltage waveforms (VD) between the first electrode (6) and the data electrodes (5, 5'), wherein the charged particles are able to occupy two limit positions between the first electrode (6) and the second electrode (5) in response to the drive voltage waveform (VD), and wherein the controller (15) is arranged for controlling the data driver (10) to supply the drive voltage waveform (VD) comprising during

20 an image update period (IUP):

a drive pulse (Vdr) having a level/and or duration in accordance with an optical state to be reached by the associated one of the pixels (18), and

a first shaking pulse (SP1) occurring during a same first shaking time period (TS1) for all the pixels (18) of the selected group of lines of pixels (18), the first shaking

25 pulse (SP1) comprising at least one preset pulse having an energy sufficient to release particles present in one of the limit positions but insufficient to enable said particles to reach the other one of the limit positions.

11. An electrophoretic display as claimed in claim 10, wherein the controller (15)

30 is arranged for controlling the data driver (10) to supply the drive voltage waveform (VD) comprising:

during an image update period (IUP) successively: (i) a reset pulse (RE) for enabling said particles to substantially occupy one of the limit positions, and (ii) the drive pulse (Vdr), and

the first shaking pulse (SP1) preceding the reset pulse (RE) or occurring between the reset pulse (RE) and the drive pulse (Vdr).

12. An electrophoretic display as claimed in claim 11, wherein the data driver (10) is arranged for generating the reset pulse (RE) having a duration depending on a difference between optical states of the pixel (18) before and after an image update period (IUP).
13. An electrophoretic display as claimed in claim 11, wherein the data driver (10) is arranged for applying the first shaking pulse preceding the reset pulse (RE) and for further generating a second shaking pulse (SP2) in-between the reset pulse (RE) and the drive pulse (Vdr), wherein the second shaking pulse (SP2) occur during a same second shaking time period (TS2) for all pixels (18) of the group of lines of pixels.
14. An electrophoretic display as claimed in claim 11, wherein the data driver (10) is arranged for generating the reset pulse (RE) with a duration longer than required to have the particles occupying one of the extreme positions.
15. An electrophoretic display as claimed in claim 11, wherein the data driver (10) is arranged for generating the reset pulse (RE) with a duration substantially proportional with a distance required for the particles to move from a present position to one of the extreme positions.
16. An electrophoretic display as claimed in claim 11, wherein, if the reset pulse (RE) has a duration shorter than a maximum duration, the data driver (10) is arranged for generating a third shaking pulse (SP3) during at least part of a third shaking period (TS3) occurring in-between the first shaking pulse (SP1) and the reset pulse (RE).
17. An electrophoretic display as claimed in claim 11, wherein, if the reset pulse (RE) has a duration shorter than a maximum duration, the data driver (10) is arranged for generating a third shaking pulse (SP3) during at least part of a third shaking period (TS3) occurring in-between the reset pulse (RE) and the drive pulse (Vdr).

18. An electrophoretic display as claimed in claim 16 or 17, wherein the data driver (10) is arranged for generating the third shaking pulse (SP3) having a lower energy content than the first shaking pulse (SP1).
- 5 19. An electrophoretic display as claimed in claim 17, wherein the data driver (10) is arranged for further generating a second shaking pulse (SP2) in-between the third shaking pulse (SP3) and the drive pulse (V_{dr}), wherein the second shaking pulse (SP2) occurs during a same second shaking time period (TS2) for all pixels (18) of a group of lines of pixels.
- 10 20. A display apparatus comprising an electrophoretic display as claimed in any one of the claims 1 to 19.
21. A method of driving an electrophoretic matrix display comprising a plurality of pixels (18), the method comprising:
- 15 selecting (16) lines of the pixels (18),
supplying (10) drive voltage waveforms (VD) to each one of the selected pixels (18) via data electrodes (5, 5'), and
controlling (15) the select driver (16) to select a group of lines of pixels (18) at a same time during portions of the drive voltage waveforms (VD) which for each of the data electrodes (5, 5') are equal for at least all the pixels (18) being associated with the same one of the data electrodes (5, 5').
- 20 22. A method as claimed in claim 18 wherein the pixels (18) comprise an electrophoretic material (8, 9) comprising charged particles, each one of the pixels (18) being associated with a first electrode (6) and one of the data electrodes (5, 5'),
the step of supplying (10) presenting the drive voltage waveforms (VD) between the first electrode (6) and the data electrodes (5, 5'), wherein the charged particles are able to occupy two limit positions between the first electrode (6) and the second electrode (5) in response to the drive voltage waveform (VD), and wherein the the step of controlling
30 (15) controls the step of supplying (10) to supply the drive voltage waveform (VD) comprising:
during an image update period (IUP) successively: (i) a reset pulse (RE) for enabling said particles to substantially occupy one of the limit positions, and (ii) a drive pulse

(Vdr) having a level/and or duration in accordance with an optical state to be reached by the associated one of the pixels (18), and

5 a first shaking pulse (SP1) occurring during a same first shaking time period (TS1) for all the pixels (18) of the selected group of lines of pixels (18), the first shaking period (TS1) preceding the reset pulse (RE) or occurring between the reset pulse (RE) and the drive pulse (Vdr), the first shaking pulse (SP1) comprising at least one preset pulse having an energy sufficient to release particles present in one of the extreme positions but insufficient to enable said particles to reach the other one of the extreme positions.